

Forest disturbance and recovery in Canada: trends and visualization from Landsat time series

Select speaking
notes added
(as well as
hyperlinks)...

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UNIVERSITY OF
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COLUMBIA



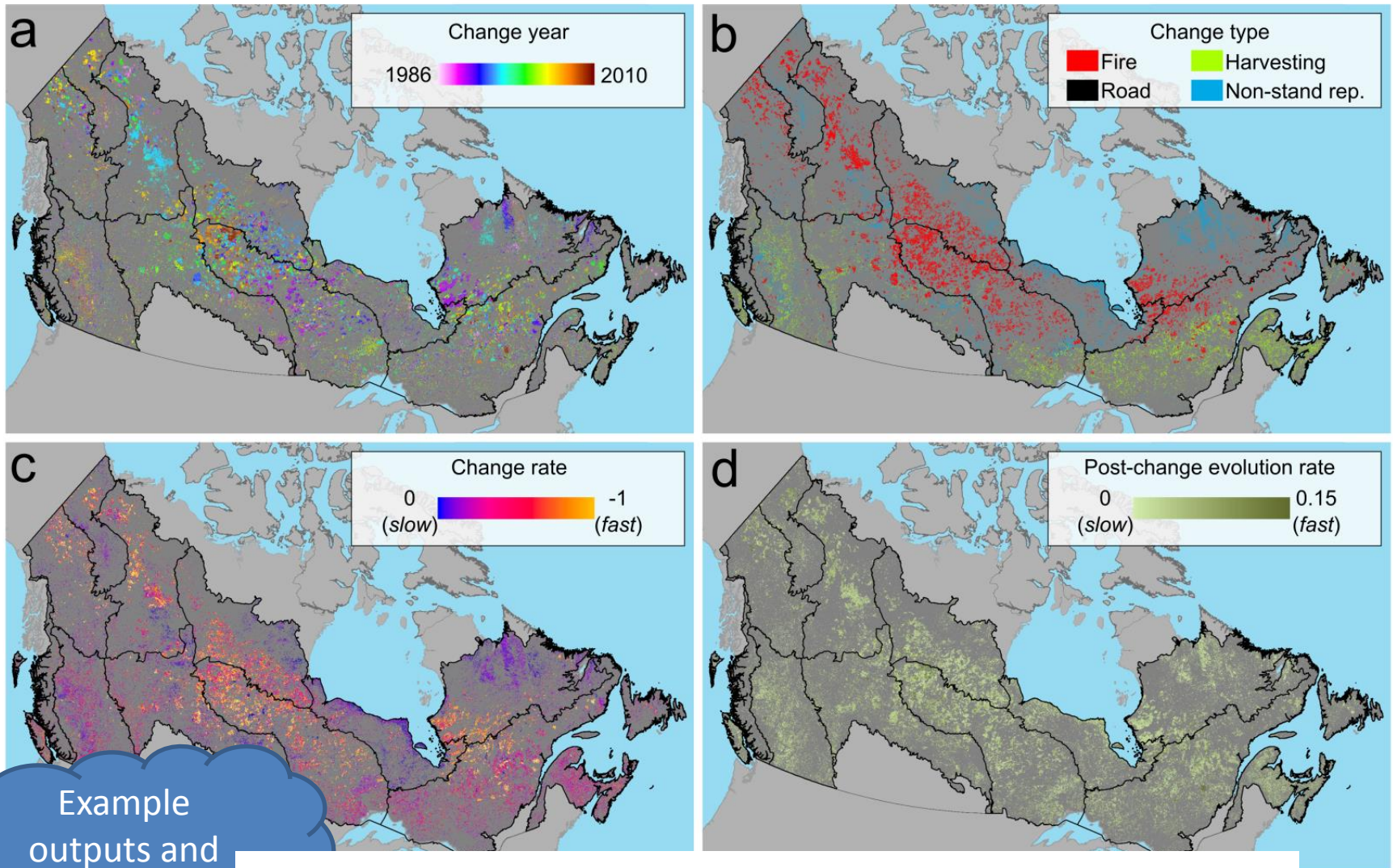
Natural Resources
Canada

Canadian Forest
Service

Ressources naturelles
Canada

Service canadien
des forêts

C2C: Change metrics

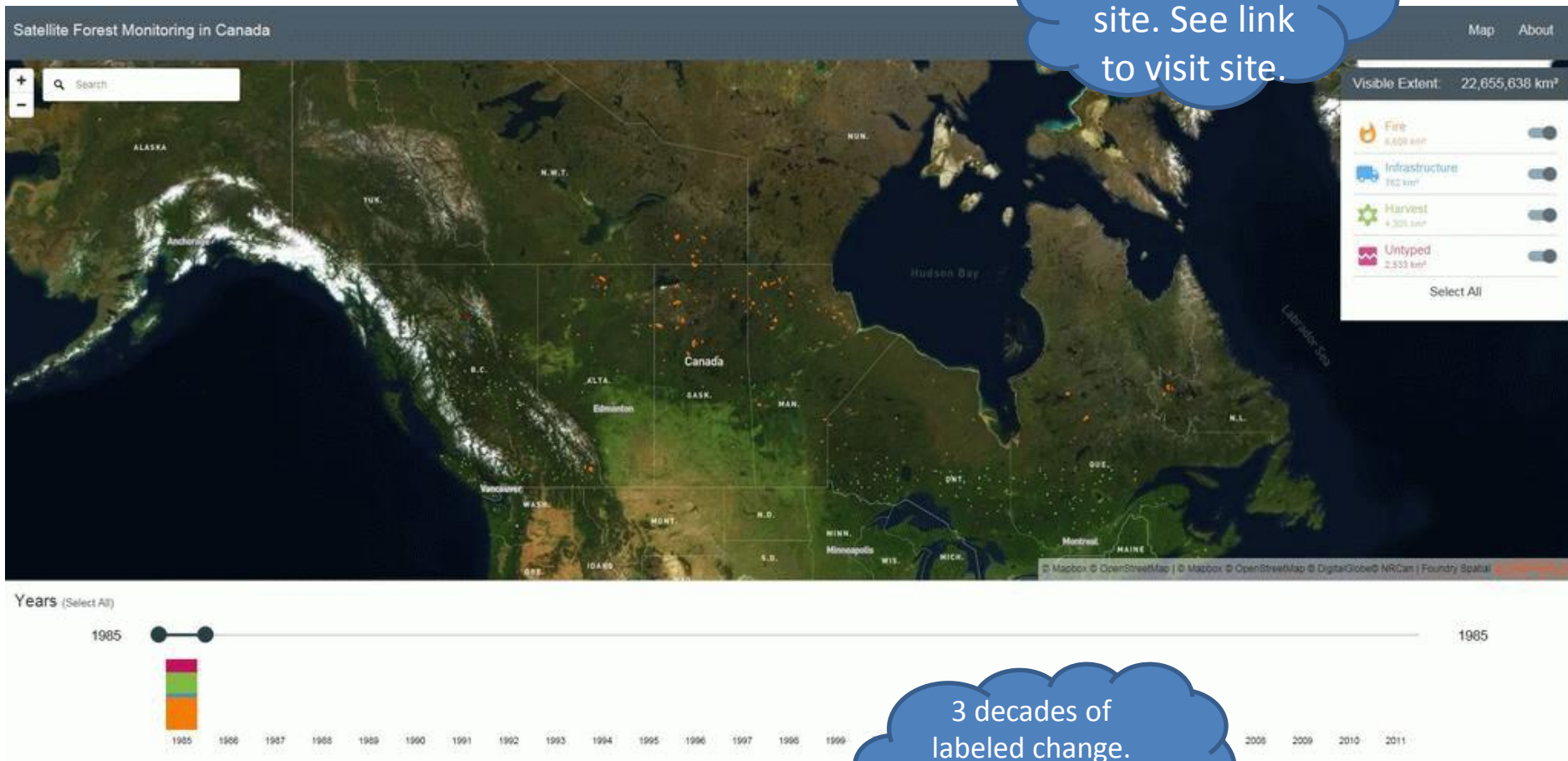


Example
outputs and
metrics. See:

Hermosilla et al. 2016. [Mass data processing of time series Landsat imagery: pixels to data products for forest monitoring.](#)

Preview: Web-based explore and discovery

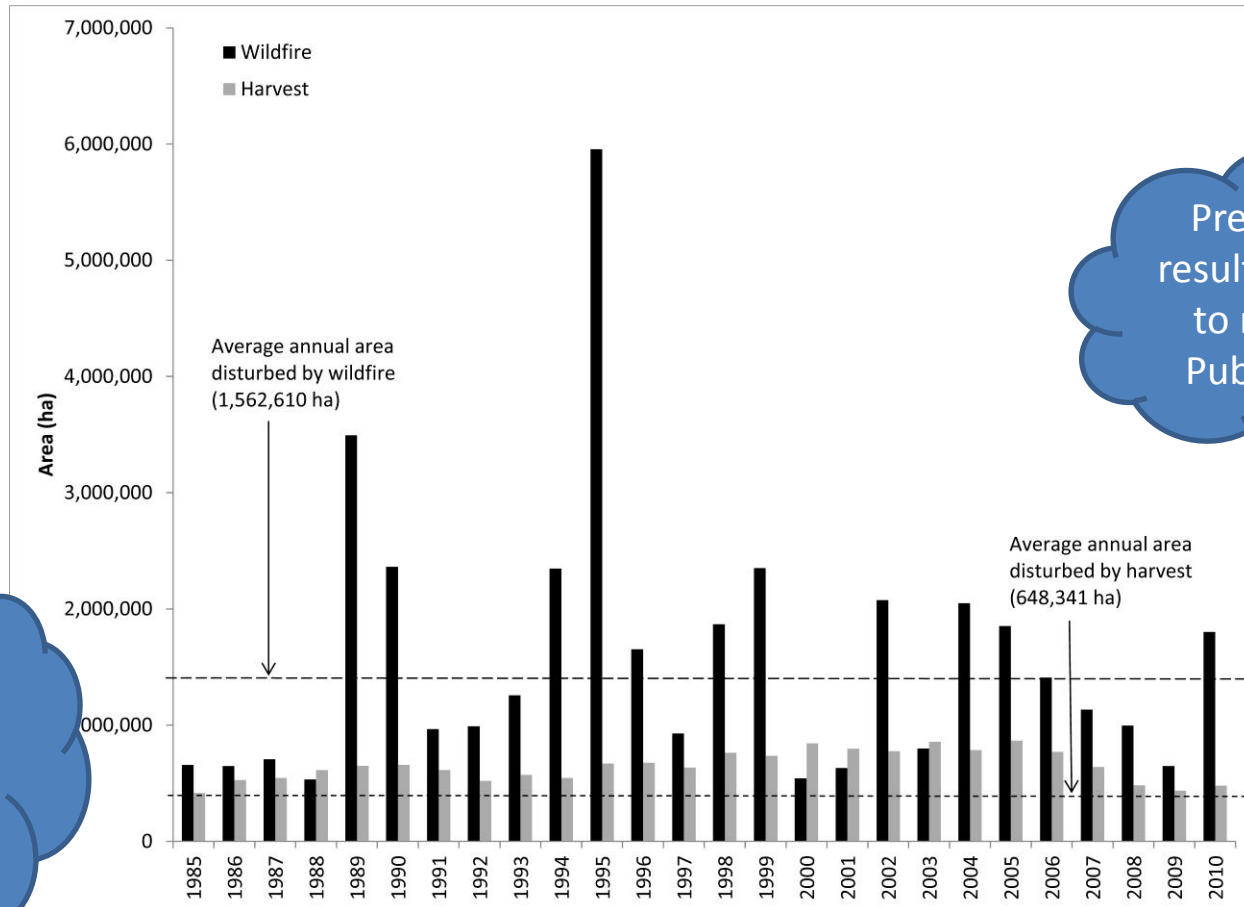
Was animation of site. See link to visit site.



3 decades of labeled change. Over 700million points shown.

<http://forests.foundryspatial.com>

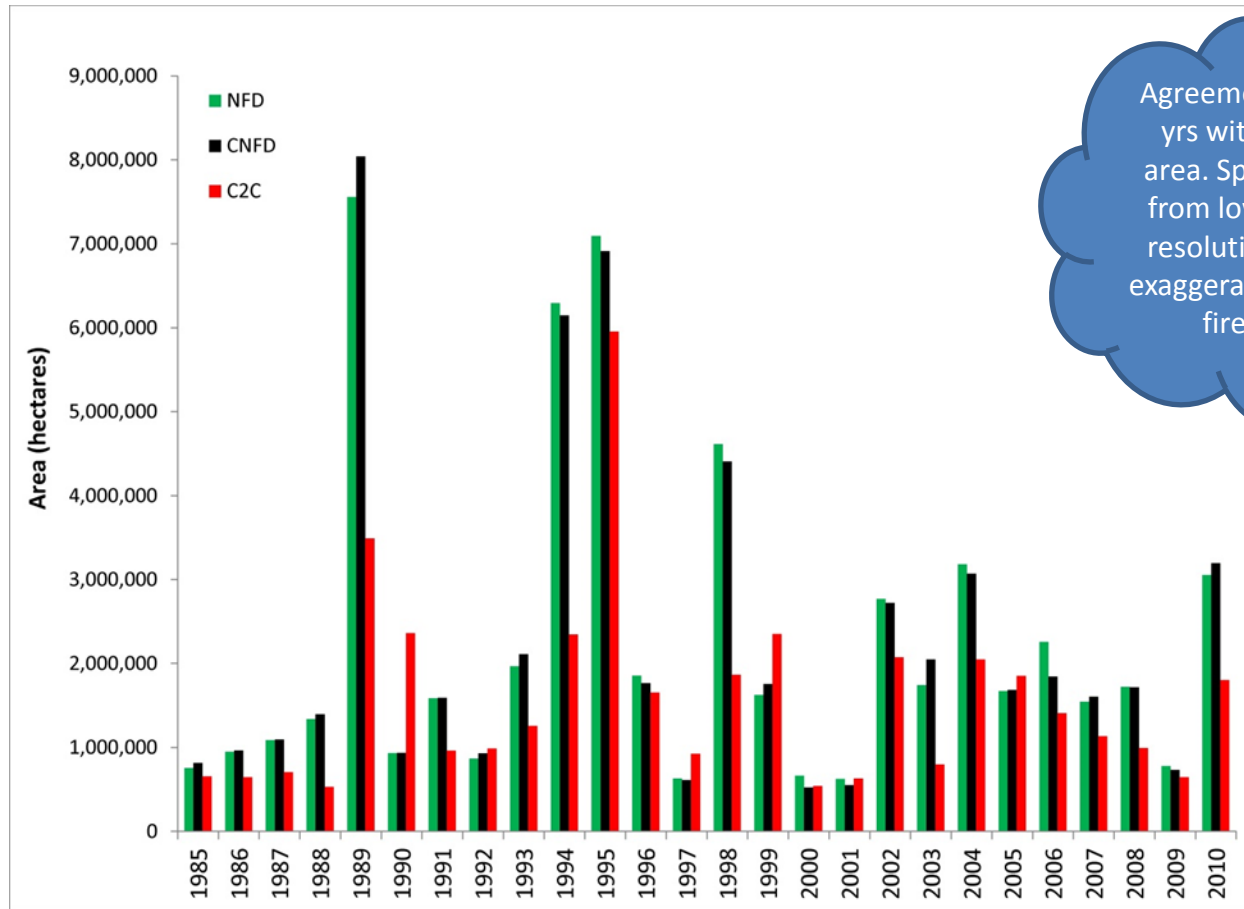
Annual area disturbed by wildfire and harvest in Canada's forested ecosystems.



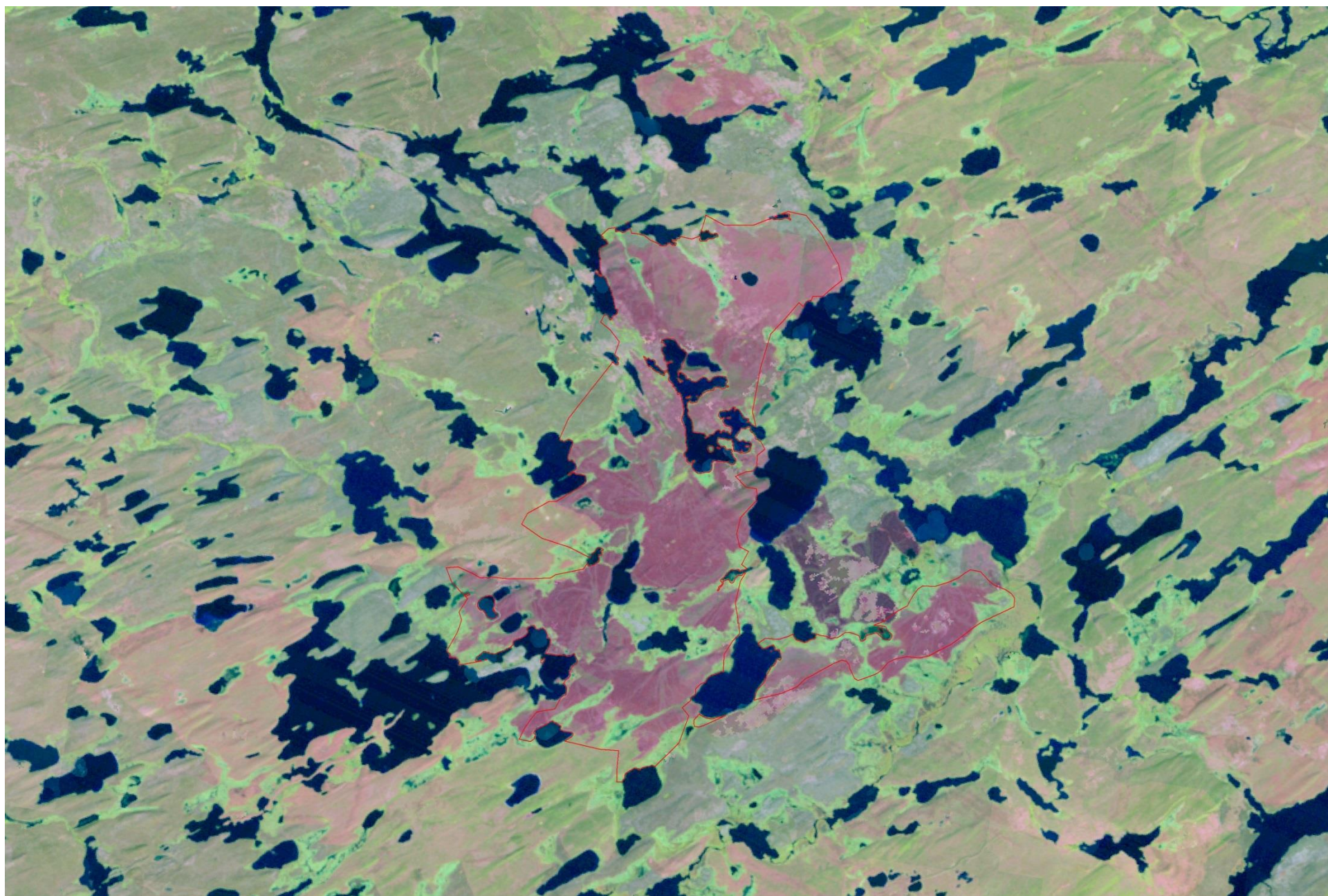
Preliminary results. Subject to revision. Pub in prep.

Note: impact of large fires on mean fire size. Harvest fairly consistent.

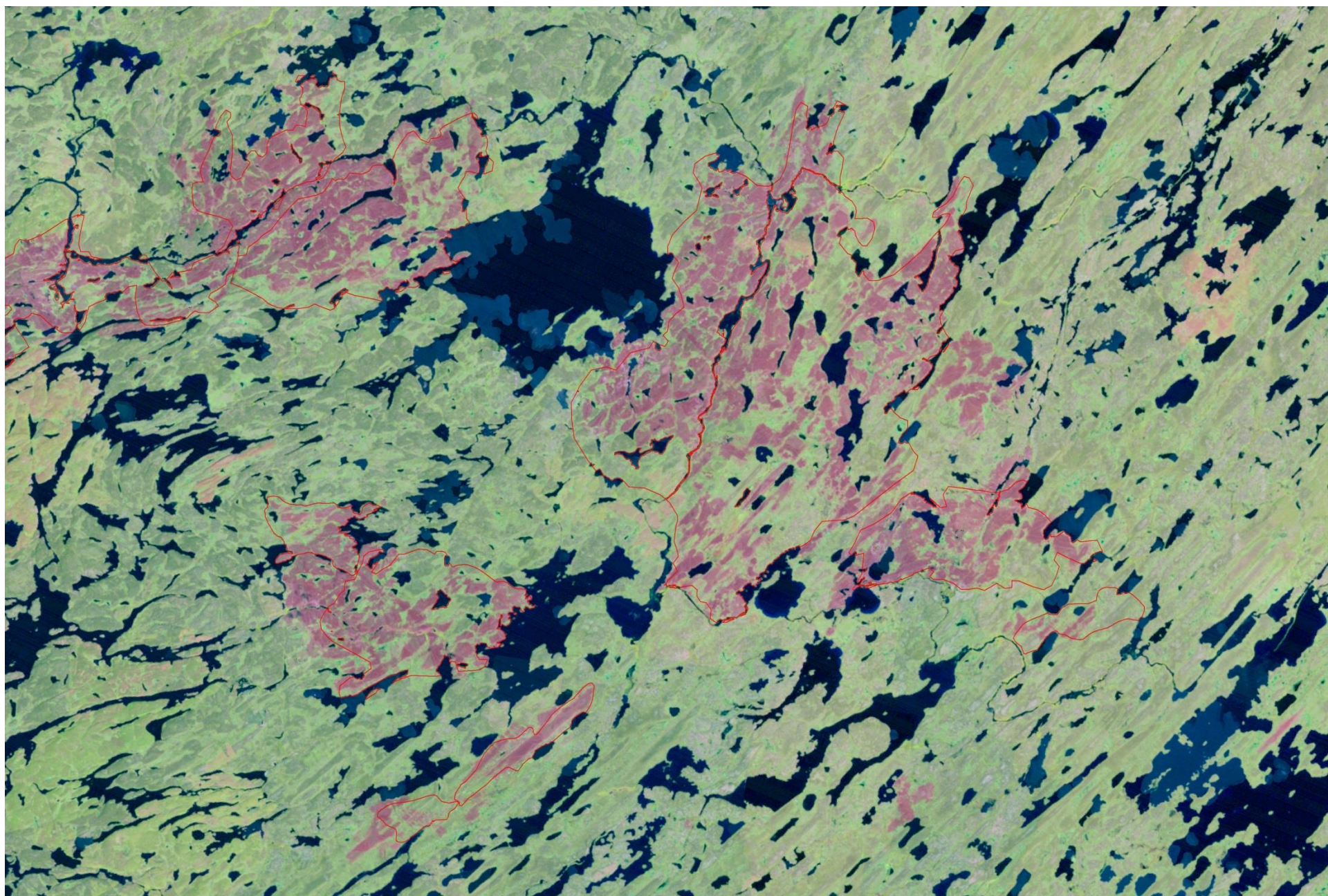
Area of wildfire in Canada's forested ecosystems (1985–2010).



Agreement best for yrs with less fire area. Spatial issues from lower spatial resolution sources exaggerated for large fire years.

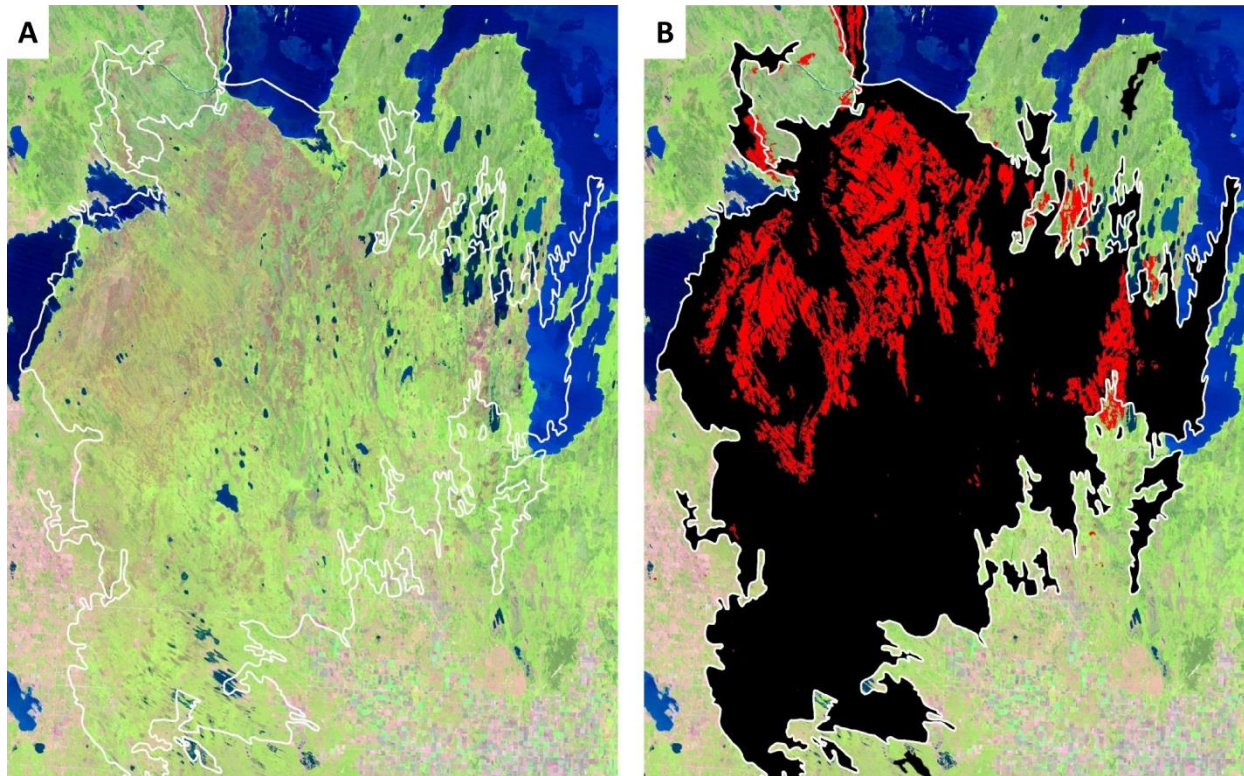


Example 2: NFDB fire perimeters

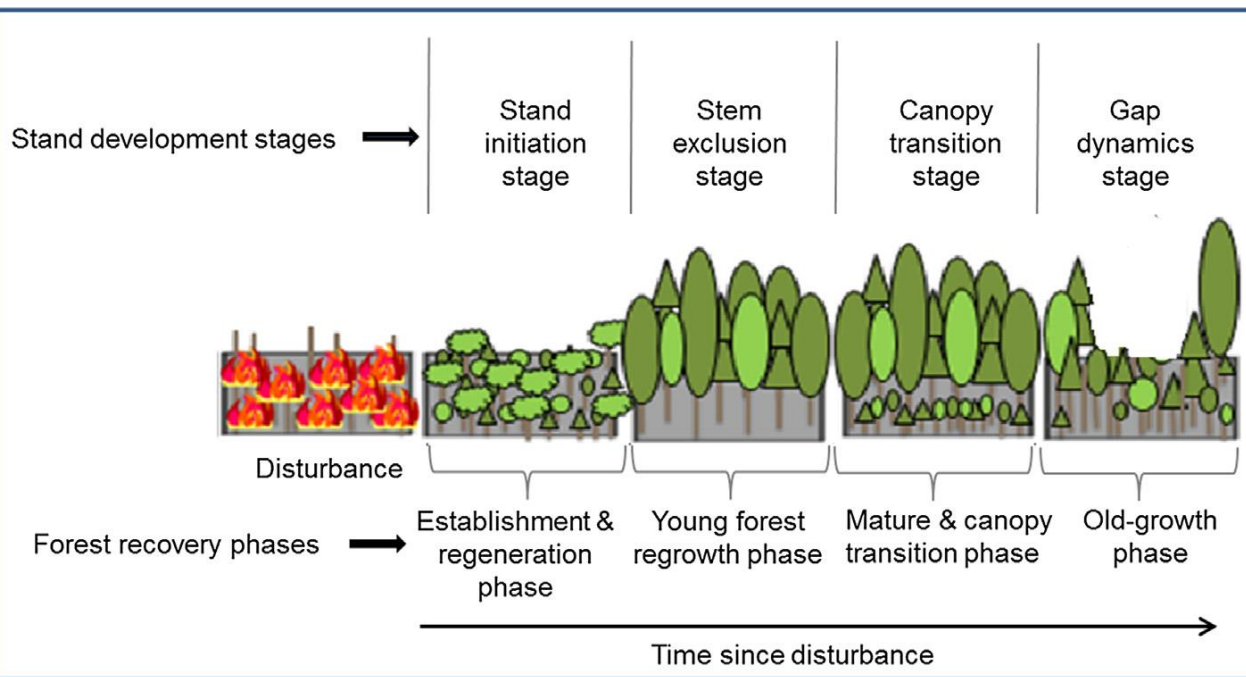


Example 3: NFDB fire perimeter

The perimeter of fire MB-1989-606029080 in southern Manitoba, with the BAP composite for 1989 (left). According to the CNFD, this fire had an area of almost 600,000 ha, and was the largest wildfire in 1989. The same fire (red) as mapped by the C2C approach for 1989 (right) was estimated to be 84,000 ha by C2C.



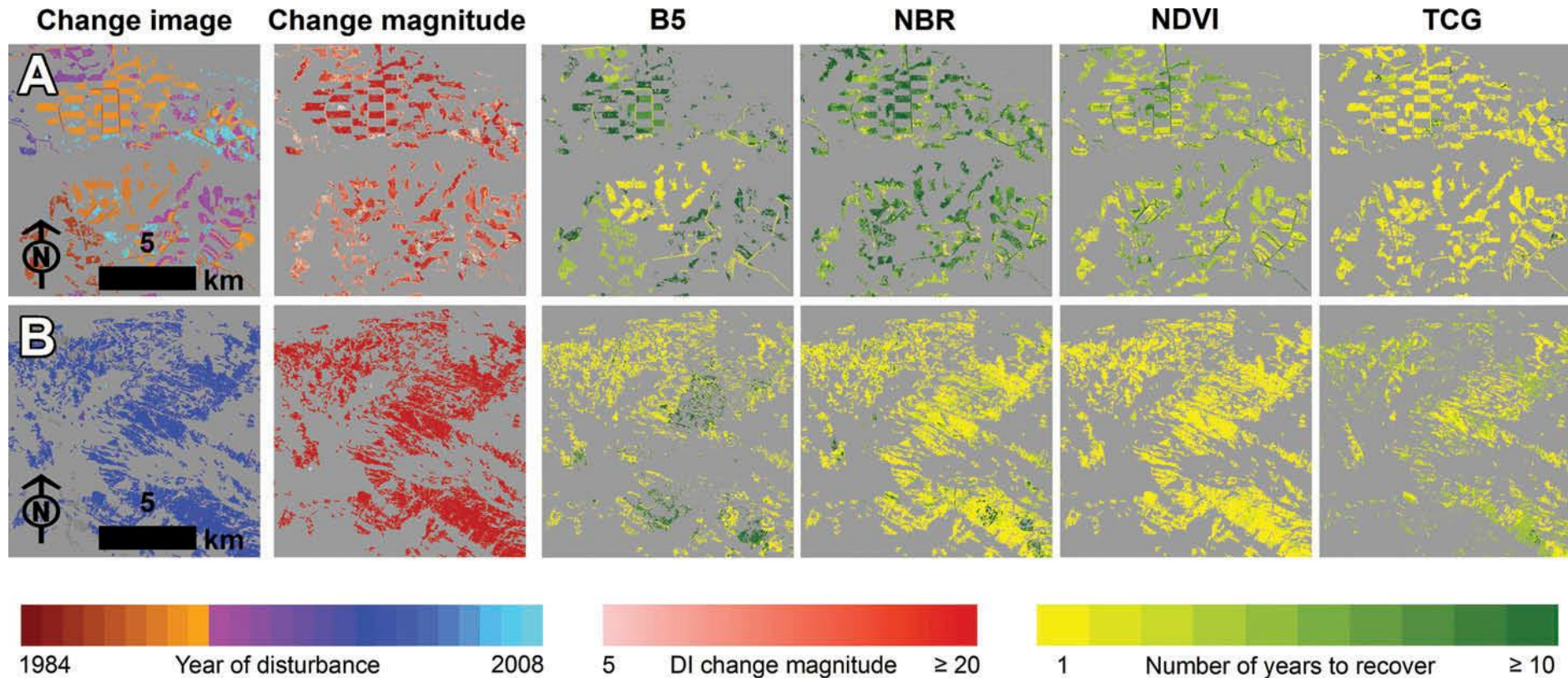
Forest recovery: Post-disturbance vegetation establishment and succession



- Interpretations:
 - Ecological
 - Silvicultural
 - Spectral

Bartels, S.F., Chen, H.Y.H., Wulder, M.A., White, J.C. 2016. [Trends in post-disturbance recovery rates of Canada's forests following wildfire and harvest.](#) Forest Ecology and Management, 361: 194–207.

Apparent spectral recovery varies



Pickell, P.D., T. Hermosilla, R. Frazier, N. C. Coops, and M.A. Wulder. (2015). [Forest recovery trends derived from Landsat time series for North American boreal forests](#). International Journal of Remote Sensing. Vol. 37, No. 1, pp. 10 138-149.

Indicators of forest recovery

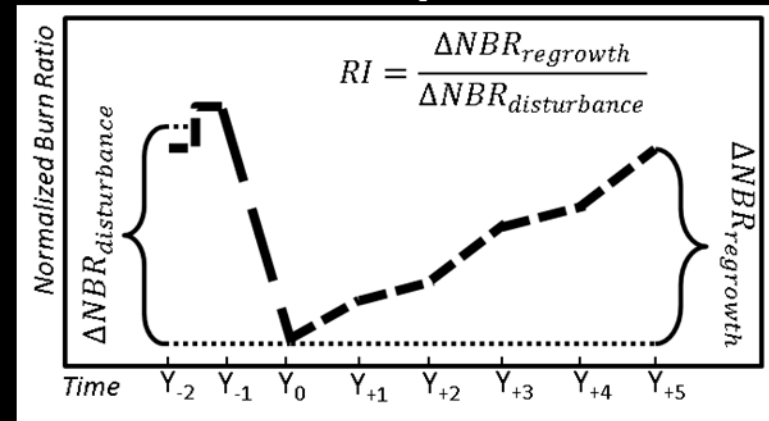
- Years to Recovery, Y2R
- Number of years it takes for a pixel to attain 80% of its pre-disturbance NBR value
 - Pre-dist is mean of 2 years prior to disturbance.
- - After Pickell et al. 2015

Hyperlinks:

[Pickell et al. 2015](#)

[Kennedy et al. 2012.](#)

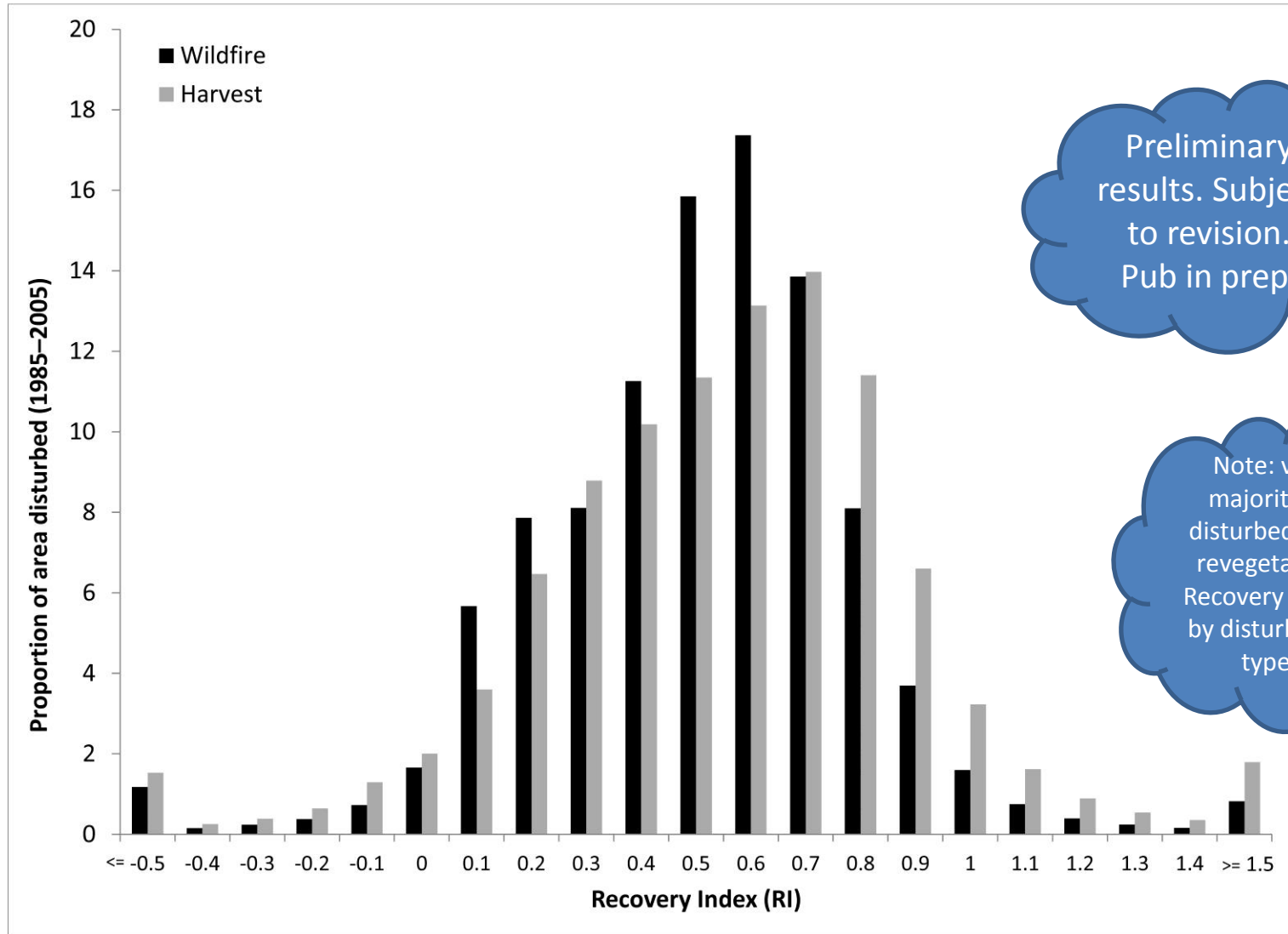
Recovery Indicator



RI: Post-disturbance regrowth metric over magnitude of the disturbance segment

- After Kennedy et al. 2012

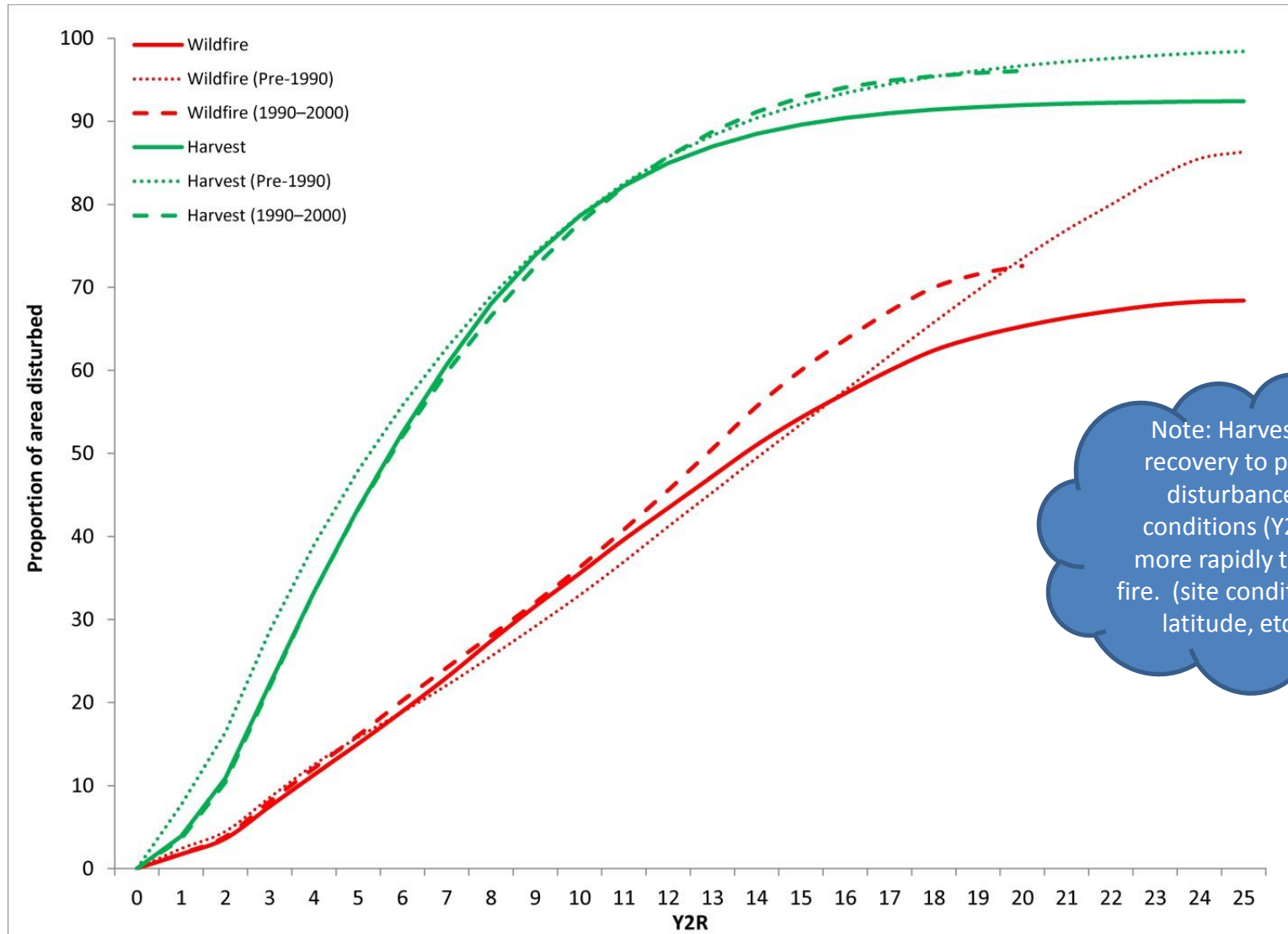
National distribution of Recovery Index values for wildfire and harvest.



Preliminary results. Subject to revision. Pub in prep.

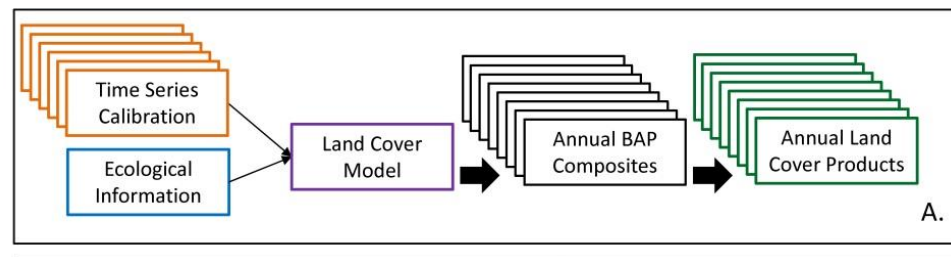
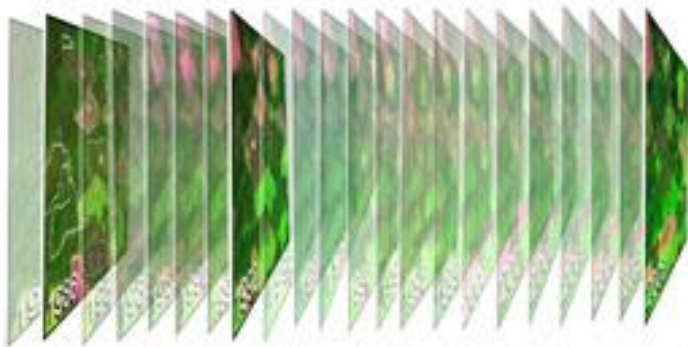
Note: vast majority of disturbed area revegetating. Recovery varies by disturbance type.

National summary of Y2R values.



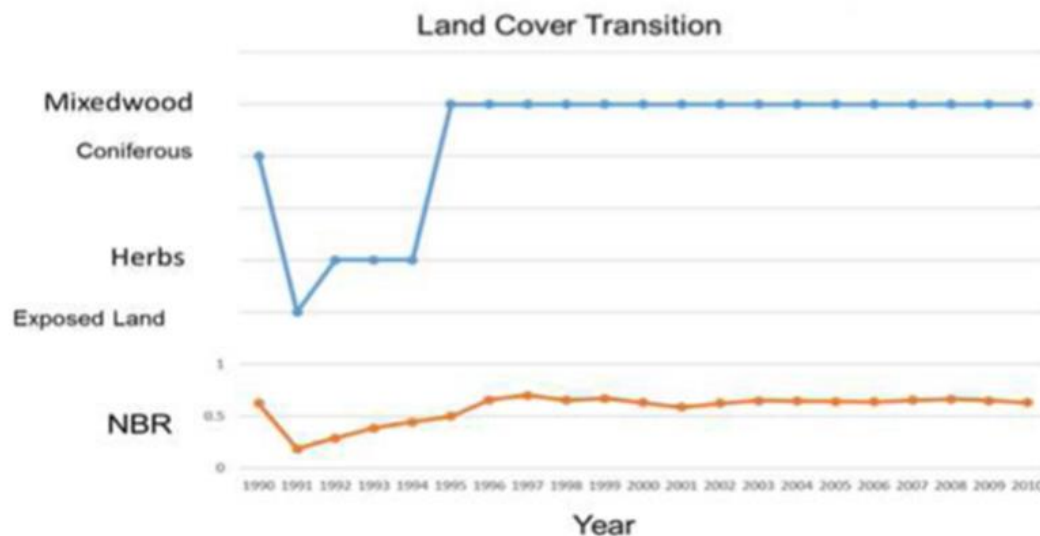
Note: Harvests recovery to pre-disturbance conditions (Y2R) more rapidly than fire. (site conditions, latitude, etc)

Applications: Land cover mapping



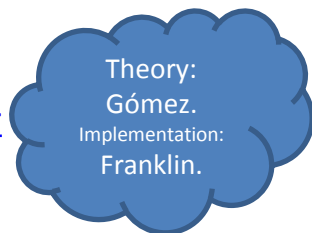
Time series of imagery plus plots, subject to classification and modeling.

Can classify land cover with knowledge of disturbances and use the year-on-year data to reconcile the annual maps.

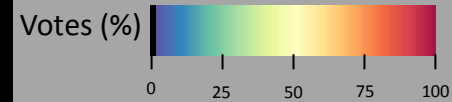


Gómez, C., White, J.C., Wulder, M.A. (2016). [Optical remotely sensed time series data for land cover classification: A review.](#) ISPRS Journal of Photogrammetry and Remote Sensing. Vol. 116, pp. 55-72

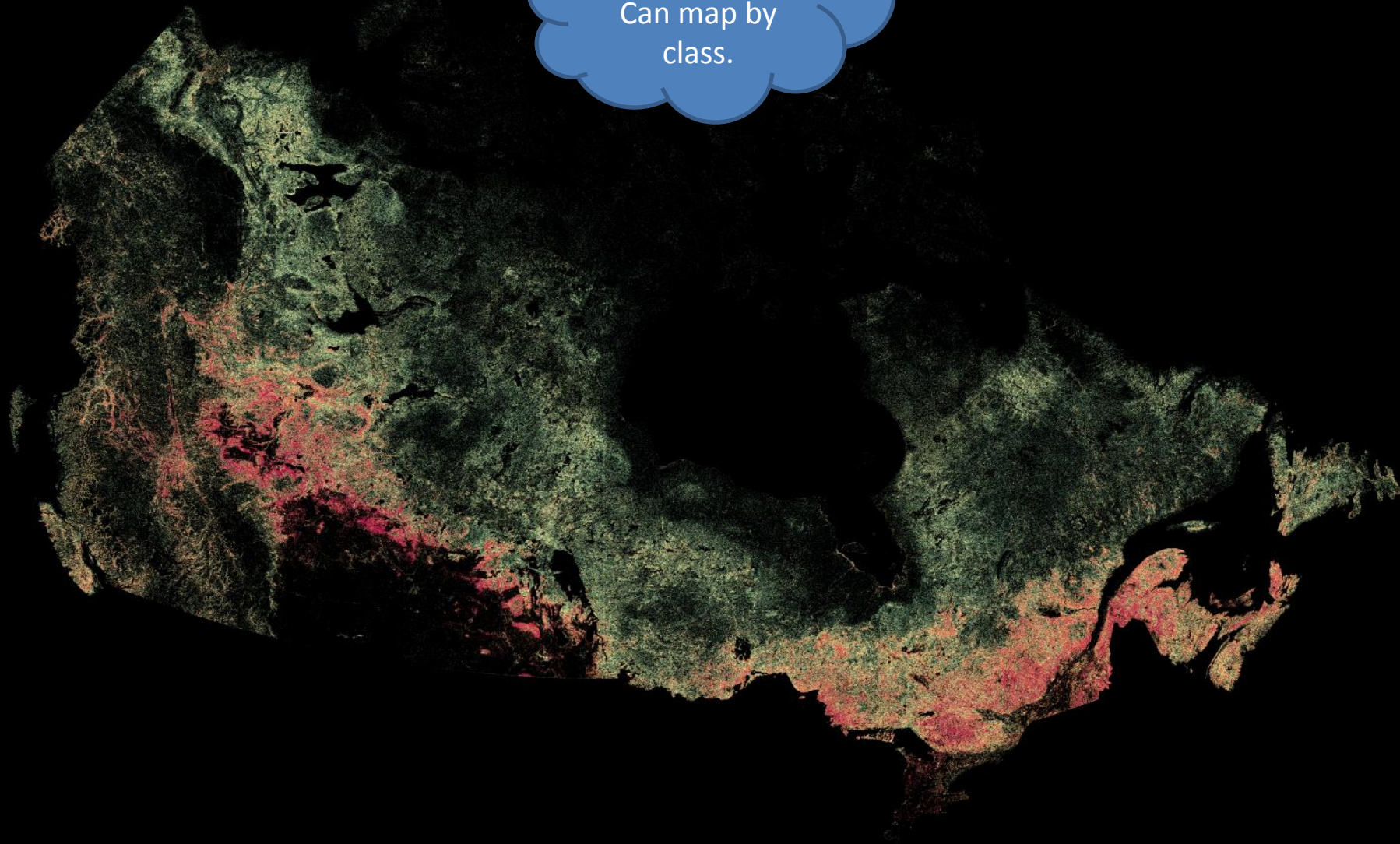
Franklin, S.E., Ahmed, O.S., Wulder, M.A., White, J.C. et al. 2015. [Large area mapping of annual land cover dynamics using multi-temporal change detection and classification of Landsat time series data.](#) Canadian Journal of Remote Sensing. [DOI:10.1080/07038992.2015.1089401](#)



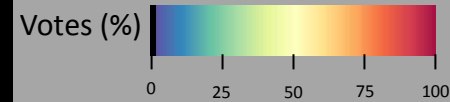
Broadleaf



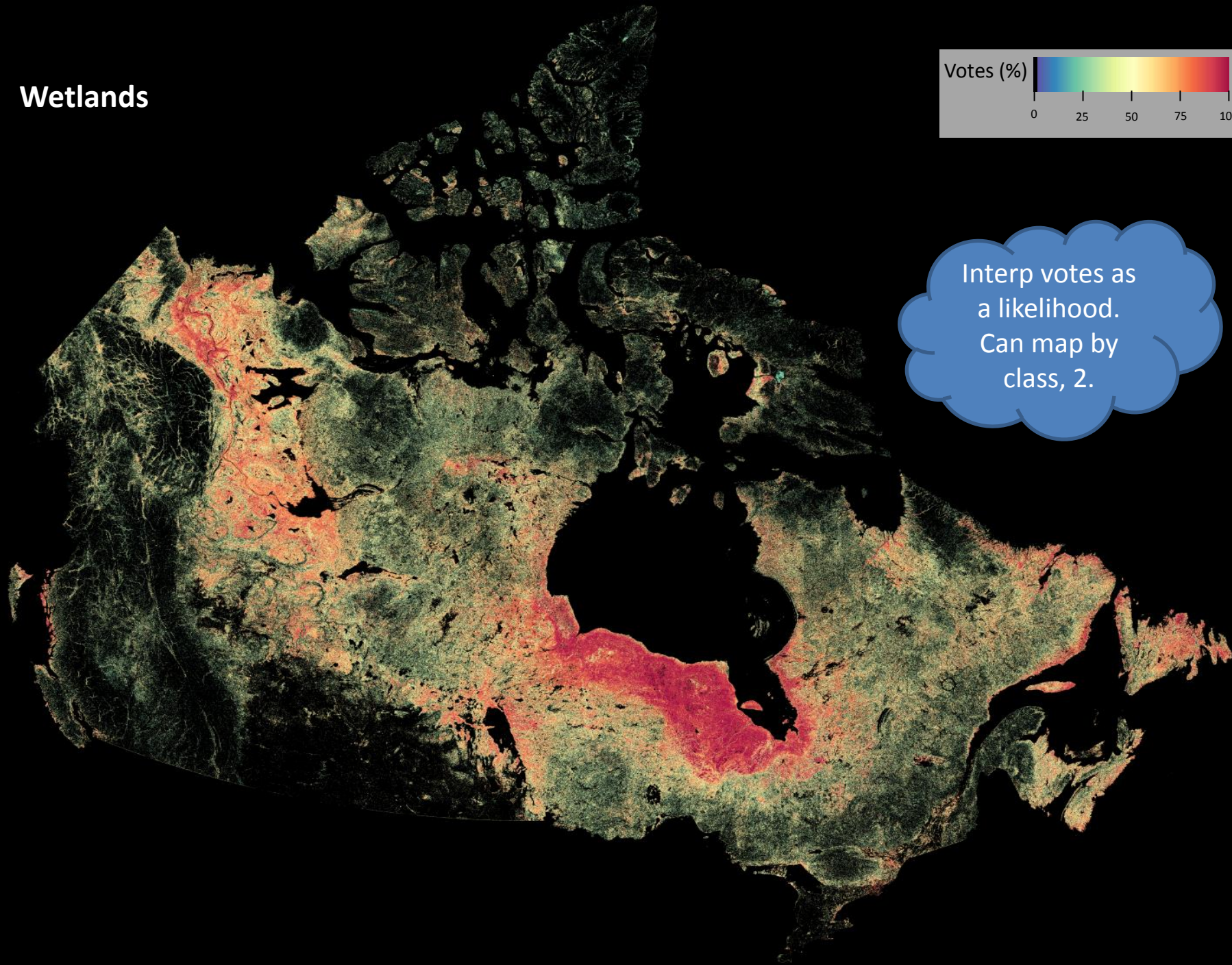
Interp votes as
a likelihood.
Can map by
class.



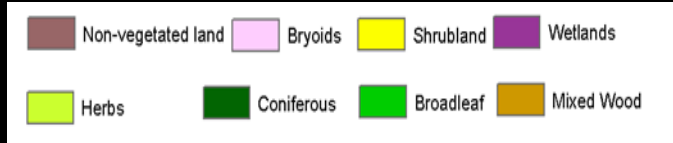
Wetlands



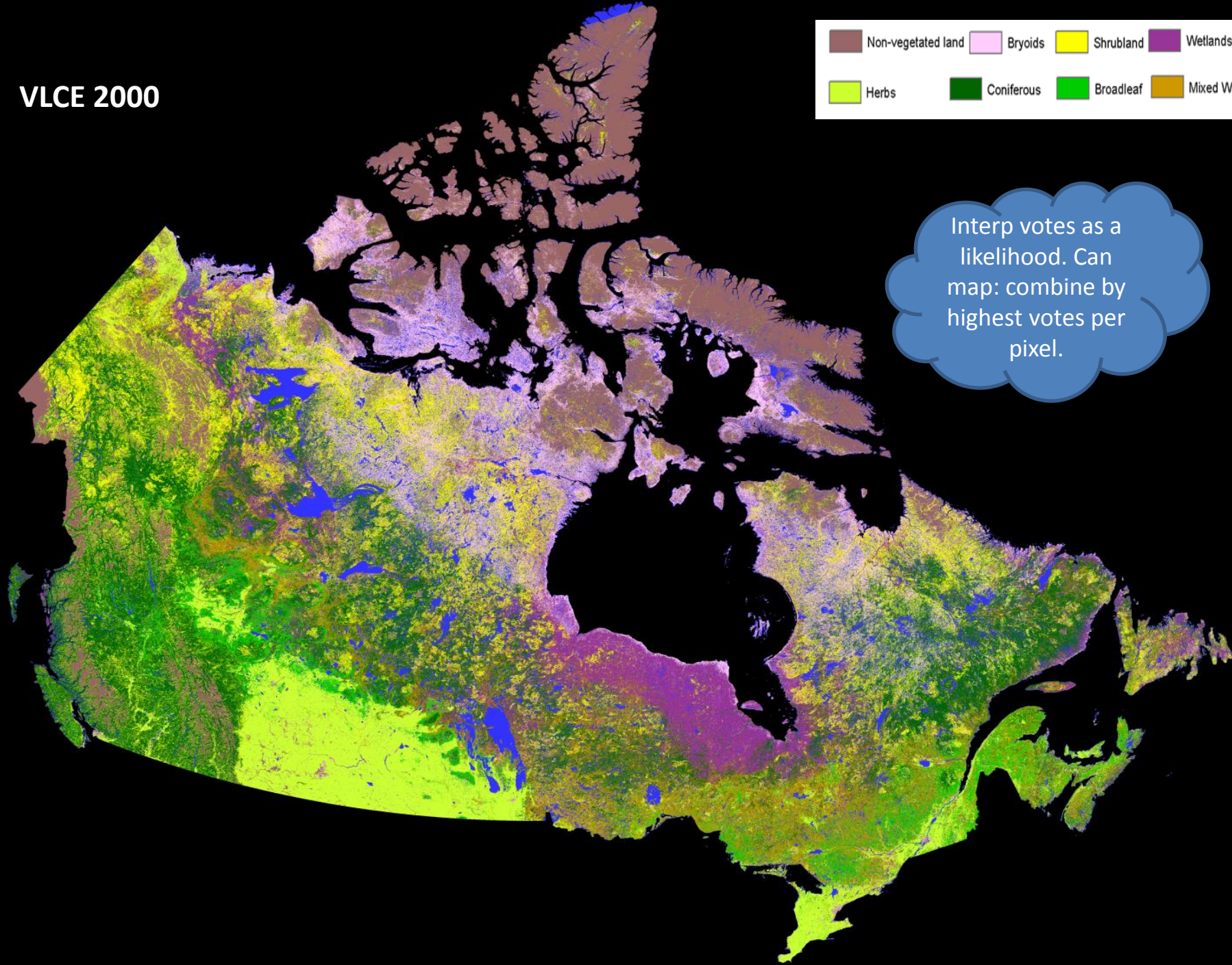
Interp votes as
a likelihood.
Can map by
class, 2.



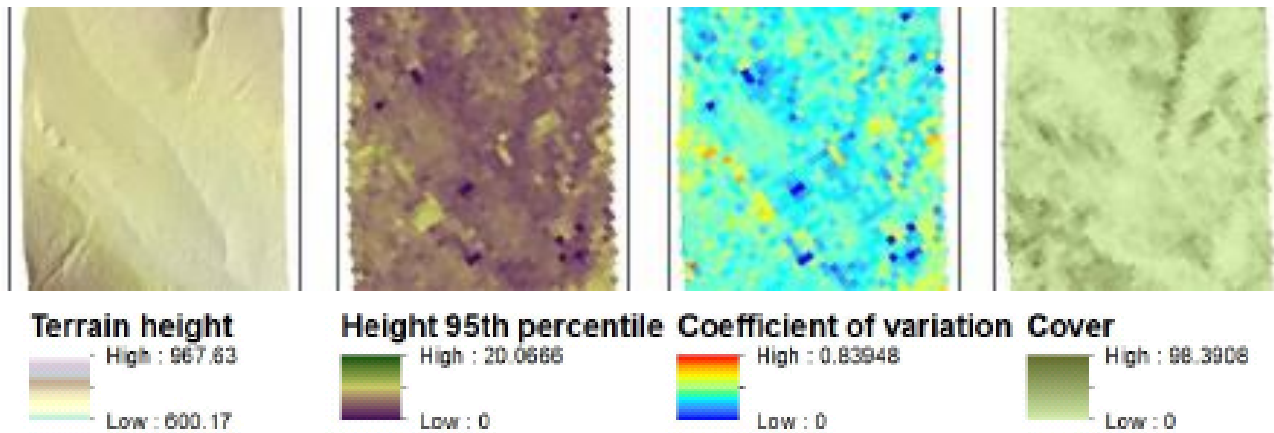
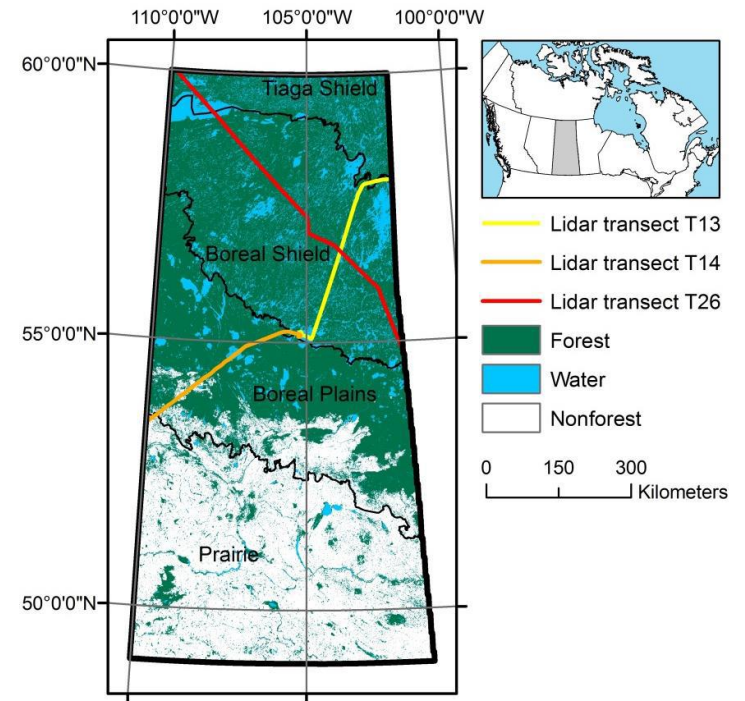
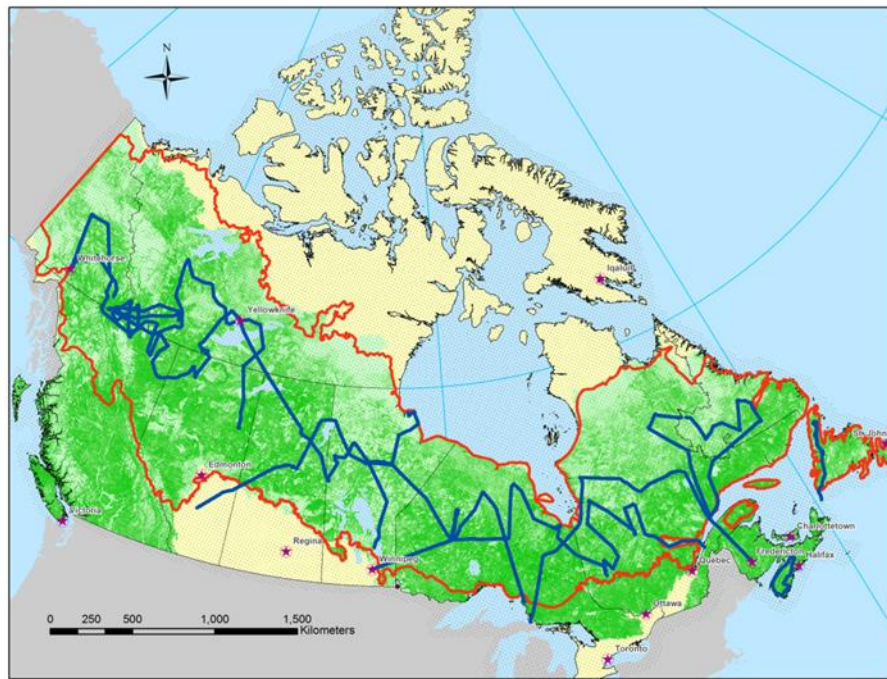
VLCE 2000



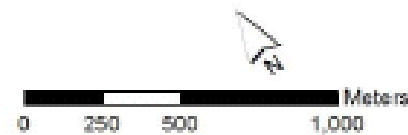
Interp votes as a likelihood. Can map: combine by highest votes per pixel.



Applications: Biomass, forest structure

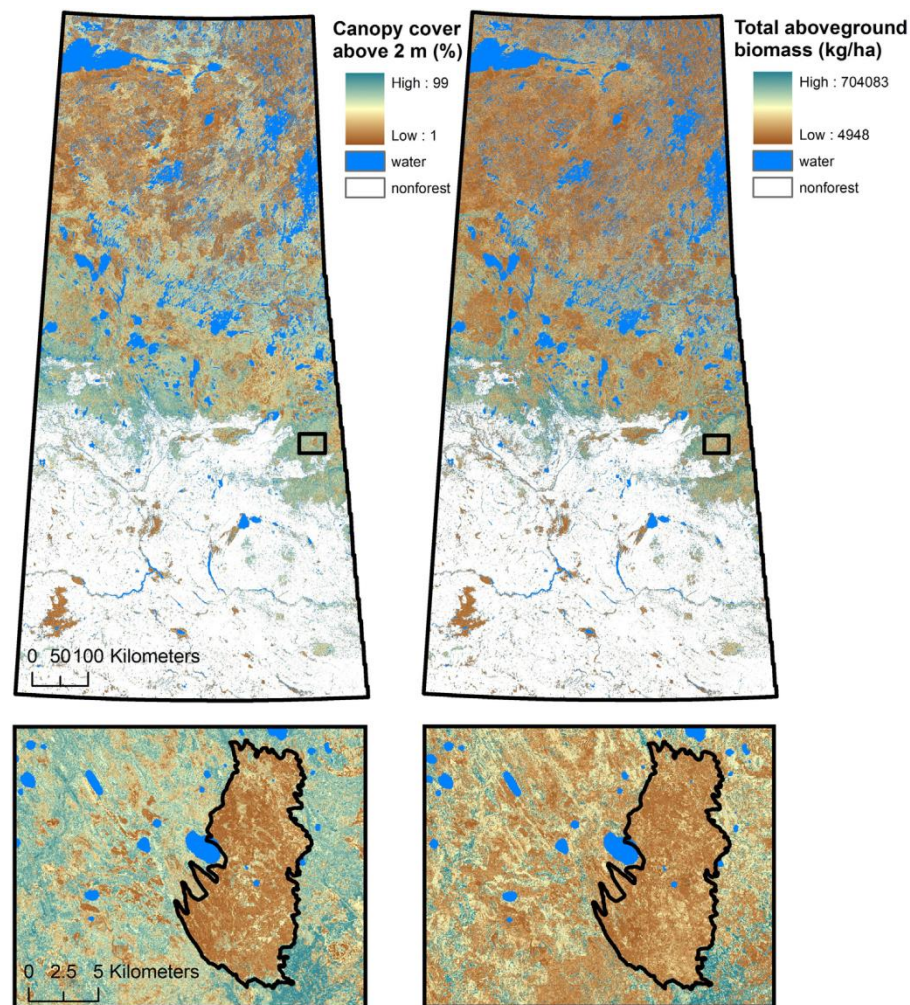


Wulder, M.A., et al.. (2012). [Lidar plots—a new large-area data collection option: context, concepts, and case study](#). CIRS. 38:5, 600-618.



Applications: Mapping forest structure

- BAP proxy composites and ALS “plots” (derived from transects)
- Imputation of ALS metrics and attributes
- Now implementing nationally (CC, Ht, biomass, BA, ...)



Zald, H.S.J., Wulder, M.A., White, J.C., Hilker, T., Hermosilla, T., Hobart, G.W., Coops, N.C. 2016. [Integrating Landsat pixel composites and change metrics with lidar plots to predictively map forest structure and aboveground biomass in Saskatchewan, Canada](#). *Remote Sensing of Environment*, 176: 188–201.

Thank you!

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Natural Resources
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Ressources naturelles
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Publications: https://www.researchgate.net/profile/Michael_Wulder

This research was undertaken as part of the “**National Terrestrial Ecosystem Monitoring System (NTEMS): Timely and detailed national cross-sector monitoring for Canada**” project jointly funded by the Canadian Space Agency (CSA) Government Related Initiatives Program (GRIP) and the Canadian Forest Service (CFS) of Natural Resources Canada.